for one or more grooves that serve the above purpose of improving mixing and saturation of the carrier gas with the vapor.

[0032] A process for vaporization/sublimation may proceed as follows. A canister is filled with a substance to be vaporized or sublimated. The plate **5** is lowered into the canister, and rests on top of the substance. The canister is closed off (sealed) and the temperature of the plate is raised and controlled to a desired level, e.g., by passing thermal fluid through a passage in the plate. A carrier gas is introduced into the canister, e.g., though the bottom of the canister into a carrier gas passage (e.g., a telescopic tube) that extends through the substance, to the bottom face of the plate. The carrier gas emerges at the top end of the telescopic tube where it then mixes with the vapor below the bottom surface of the plate, and the vapor-gas mixture emerges past the side or edge of the plate into a space above the plate (inside the canister). The vapor-gas mixture is drawn (e.g., pumped) out of the canister through an outlet (e.g., formed in a lid at the top of the canister). In the meantime, the temperature of the plate and that of the canister as a whole may be regulated to ensure an isothermal condition for the vaporization/sublimation process, and to improve consistency of the process by maintaining a desired temperature between the plate and the top of the substance (through regulation of the heat released by the plate). As the substance is consumed, and vapor-gas mixture continues to be drawn out of the canister, and the plate, which is moveable, essentially maintains its horizontal orientation and adjacent position against a top surface of part of the substance, and moves downward (e.g. due to gravity alone) as the top level of the substance drops. The vaporization/sublimation process may therefore be more consistent even as the substance continues to be consumed.

[0033] Another embodiment of an apparatus for vaporization or sublimation of a chemical includes a chamber body whose bottom is moveable, relative to the temperature regulated plate, as compared to the embodiments described above in which the bottom is joined to the sidewall of the chamber body. The substance or chemical is held against the bottom of the chamber body. In this embodiment, the plate may remain fixed in position inside the chamber body during the vaporization or sublimation. Initially, the plate (e.g., its bottom surface) may be in contact with a surface of the chemical. As the vaporization or sublimation process takes place, the chemical is consumed and its surface will otherwise drop away from the plate, except that a mechanism for maintaining surface contact between the surface of the chemical and the plate is also provided. An example of such a mechanism is a syringe that operates to move the bottom of the chamber body upward (e.g., pushes upward against the bottom, or the plunger and tube of the syringe form part of the chamber body including its bottom), as the chemical is consumed during the sublimation or vaporization. Another example is an inflatable bellows that lifts the bottom of the chamber body upward, as the chemical is consumed during the sublimation or vaporization. Yet another example of a mechanism that can push the plate upward is a diaphragm.

[0034] While certain embodiments have been described and shown in the accompanying drawings, it is to be understood that such embodiments are merely illustrative of and not restrictive on the broad invention, and that the invention is not limited to the specific constructions and arrangements shown and described, since various other modifications may occur to those of ordinary skill in the art. For example, the same heating fluid may be circulated through all of the thermal fluid passages shown in FIG. **3**, including the passage **11** inside the lid **4**, the inlet and outlet tubings **14**, **12**, the thermal fluid passage **13** inside the plate **5**, and the passage **17** inside the thermal jacket **8**. Alternatively, there may be separate plumbing provided for some or all of these thermal fluid passages, which connect to separate thermal fluid sources (pumps) and valves, to control the isothermal condition. For example, the thermal jacket **8** may be controlled independently of the heater **6** within the plate **5**. The description is thus to be regarded as illustrative instead of limiting.

What is claimed is:

1. An apparatus for vaporization or sublimation of a substance, comprising:

a canister having a chamber body in which a substance is to be held for vaporization of sublimation; and

a plate moveably positioned in the chamber body, the plate having a fluid passage formed therein;

inlet tubing located inside the chamber body and having an inlet and an outlet, wherein the inlet is connected to a fluid inlet port in the canister, and the outlet is connected to the fluid passage in the plate; and

outlet tubing located inside the chamber body and having an inlet and an outlet, wherein the inlet is connected to the fluid passage in the plate and the outlet is connected to a fluid outlet port in the canister, wherein a fluid is to circulate through the inlet tubing, the fluid passage in the plate, and the outlet tubing.

2. The apparatus of claim **1** wherein the canister further comprises a lid at a top of the canister,

wherein the fluid inlet port in the canister, to which the inlet tubing is connected, is formed in the lid, and the fluid outlet port in the canister, to which the outlet tubing is connected, is also formed in the lid.

3. The apparatus of claim **1** wherein portions of the inlet tubing and the outlet tubing that are inside the chamber body are formed as coils, respectively, wherein the coils are compressed initially and then lengthen as the plate moves downward in the chamber body.

4. The apparatus of claim **3** wherein the portion of the inlet tubing that is formed as a coil has as inlet rings, and the portion of the outlet tubing that is formed as a coil has outlet rings, wherein the inlet and outlet rings of the coils are interleaved.

5. The apparatus of claim **4** wherein the chamber body has a cylindrical sidewall, the portion of the inlet tubing that is formed as a coil has a plurality of inlet rings, and the portion of the outlet tubing that is formed as a coil has a plurality of outlet rings, wherein the outside edge of each of the inlet and outlet rings conforms to the inner surface of the cylindrical sidewall.

6. The apparatus of claim **4** wherein an outermost edge of the plate extends to and is shaped to conform to the inner surface of a sidewall of the chamber body while allowing the plate to slide downward within the chamber body as the substance is vaporized or sublimated.

7. The apparatus of claim **3** wherein the plate is to move downward due to gravity alone, as the substance in the chamber body is vaporized or sublimated.

8. The apparatus of claim **1** further comprising a thermal jacket outside of, and that surrounds or covers a sidewall of, the chamber body.